CLAIMS

1. A device for determining reflection lens pupil transmission distribution in a photolithographic reflective imaging system, the device comprising:

an illumination source;

a reticle supporting a reflective mask layer having a plurality of light-reflecting areas and non-reflective areas thereon;

a diffuser mounted with respect to the reflective mask layer;

a lens system comprising one or more reflective elements; and

an image plane,

wherein a pupil image corresponding to one or more the plurality of light-reflecting areas in the reflective mask layer is formed at or near the image plane when light from the illumination source passes through the diffuser to the reflective mask layer, reflects from the light-reflecting areas and passes through the lens system, the pupil image having a reflection lens pupil transmission distribution.

2. A device as in claim 1, wherein the diffuser eliminates or substantially alters contributions of the illumination source aperture uniformity from the reflection lens pupil transmission distribution.

3. A device as in claim 1, wherein the light-reflecting areas or the non-reflecting areas in the reflective mask layer have a substantially same predetermined size and shape and are spaced apart from one another so that overlap between the pupil images at the image plane is avoided while measuring intensity and/or uniformity of the pupil images is enabled.

4. A device as in claim 1, wherein the diffuser at least partially homogenizes or randomizes one or more of intensity, spatial intensity

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distribution, phase, coherence and propagation direction of light passing therethrough.

5. A device as in claim 1, wherein the diffuser is a random phase plate.

6. A device as in claim 1, wherein the diffuser is configured to be oscillated during operation of the device.

7. A device as in claim 1, wherein the reflective mask layer is formed on a surface of the reticle.

8. A device as in claim 1, wherein the diffuser is removably mounted with respect to the reflective mask layer.

9. A device as in claim 1, wherein the image plane is substantially coplanar with a focal plane of light from the lens system and the reflective mask layer is offset from a focal plane of light from the illumination source.

10. A device as in claim 1, wherein the image plane is offset from a focal plane of light from the lens system and the reflective mask layer is substantially coplanar with a focal plane of light from the illumination source.

11. A method for determining reflection lens pupil transmission distribution and illumination source aperture uniformity in a photolithographic imaging system, comprising:

providing a photolithographic imaging system comprising:

an illumination source,

a reticle supporting a reflective mask layer having a plurality of light-reflecting areas and non-reflecting areas thereon, and

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a lens system comprising one or more reflective elements;

measuring first pupil intensity distribution of one or more first pupil image at an image plane, the one or more first pupil image formed by light reflected by corresponding ones of the plurality of light-reflecting areas while passing light from the illumination source to the reflective mask layer and through the lens system;

mounting a diffuser with respect to the reflective mask layer;

measuring second pupil intensity distribution of one or more second pupil image at the image plane, the one or more second pupil image formed by light reflected by corresponding ones of the plurality of light-reflecting areas while passing light from the illumination source, to the diffuser, to the reflective mask layer and through the lens system; and

comparing the first and the second pupil intensity distributions to determine intensity distribution of radiation emanating from the illumination source and the lens system.

12.   A method as in claim 11, wherein the diffuser eliminates or substantially alters contributions of the illumination source aperture uniformity from the reflection lens pupil transmission distribution.

13.   A method as in claim 11, wherein the light-reflecting areas or the non-reflecting areas in the reflective mask layer have a substantially same predetermined size and shape and are spaced apart from one another so that overlap between the respective first or second pupil images at the image plane is avoided while measuring intensity and/or uniformity of the first and second pupil images is enabled.

14.   A method as in claim 11, wherein use of the diffuser decouples contributions to the second pupil image arising from the illumination source aperture uniformity from contributions arising from the lens system.

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15.   A method as in claim 11, wherein the first pupil intensity distribution substantially corresponds to combined effects of illumination source intensity distribution and lens system pupil transmission distribution.

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16.   A method as in claim 11, wherein the second pupil intensity distribution substantially corresponds to lens system pupil distribution.

17.   A method as in claim 11, further comprising oscillating the diffuser during the step of measuring second pupil intensity distribution.

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18.   A device for determining both illumination source aperture uniformity and reflection lens pupil transmission distribution in a photolithographic reflective imaging system, the device comprising:

an illumination source;

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a reticle supporting a reflective mask layer having a plurality of light-reflecting areas and non-reflecting areas thereon;

a diffuser removably mounted with respect to the reflective mask layer;

a lens system comprising one or more reflective elements; and

an image plane,

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wherein a first pupil image corresponding to one or more of the plurality of light-reflective areas in the reflective mask layer is formed at or near the image plane when the diffuser is removed and light from the illumination source reflects from the light-reflecting areas and passes through the lens system, the first pupil image having a first pupil intensity distribution $P_{(x,y)\ no\ diffuser}$; and

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wherein a second pupil image corresponding to one or more of the plurality of light-reflective areas in the reflective mask layer is formed at or near the image plane when the diffuser is mounted and light from the illumination source passes through the diffuser, reflects from the light-reflecting areas and passes through the lens system, the second pupil image having a second pupil intensity distribution $P_{(x,y)\ diffuser}$, and

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wherein the following relationships are defined:

$$P_{(x,y)\,diffuser} \cong P_{(x,y)\,reflective\,lens} \tag{1}$$

and

$$P_{(x,y)\,diffuser} / P_{(x,y)\,no\,diffuser} \cong P_{(x,y)\,illumination\,source} \tag{2}.$$

19.   A device as in claim 18, wherein the diffuser at least partially homogenizes one or more of spatial intensity distribution, phase, coherence and propagation direction of light passing therethrough.

20.   A device as in claim 18, wherein the diffuser at least partially homogenizes or randomizes one or more of intensity, spatial intensity distribution, phase, coherence and propagation direction of light passing therethrough.